

Catalogue of American Amphibians and Reptiles.

Powell, R. and R.D. Wittenberg. 1998. *Bothrops caribbaeus*.

***Bothrops caribbaeus* (Garman)**
Saint Lucia Lancehead

Bothrops subscutatus Gray 1842:47. Type locality, "Demerara." Holotype not designated, but is (G. Underwood, in litt., 8.VIII.92, to J.D. Lazell, Jr.; P.J. Stafford, in litt., 26.VII.98), British Museum (Natural History) (BMNH) 1946.1.19.59, an adult female, collected by E. Sabine, date of collection unknown, but likely early 1930s (not examined by authors). *Incertae sedis* (see Nomenclatural History).

Bothrops Sabinii Gray 1842:47. Type locality, "Demerara." Syntypes not designated, but are (G. Underwood, in litt., 8.VIII.92, to J.D. Lazell, Jr.; P.J. Stafford, in litt., 26.VII.98), BMNH 1946.1.18.65, a subadult female, 1946.1.19.65, an adult female, 1946.1.19.66, a subadult male, all collected by E. Sabine, dates of collection unknown (not examined by authors). *Incertae sedis* (see Nomenclatural History).

Bothrops cinereus Gray 1842:47. Type locality, "America," although Gray (1849) indicated "South America." Holotype not designated, but is (P.J. Stafford, in litt., 26.VII.98), BMNH 1946.1.18.77, a subadult female, collected by E. MacLeay, date of collection unknown, but likely before 1937; the original label is missing from this bottle (not examined by authors). *Incertae sedis* (see Nomenclatural History).

Craspedocephalus atrox: Tyler 1849:100 (part).

Bothrops lanceolatus: Duméril et al. 1854:1507 (part).

Trionocephalus lanceolatus: Cope 1870:90 (part).

Trionocephalus caribbaeus Garman 1887:285. Type locality, "St. Lucia," restricted (Lazell 1964) to "Grande Anse, [Daphin Quarter,] St. Lucia." Lectotype, Museum of Comparative Zoology (MCZ) 4814, a subadult or small adult female, collected in 1879 by S. Garman (not examined by authors).

Lachesis lanceolatus: Boulenger 1896:535 (part).

Trimeresurus lanceolatus: Mocquard 1909:939 (part).

Lachesis atrox var. *affinis*: Proctor 1918:180 (part).

Bothrops atrox: Amaral 1925:28 (part).

Bothrops caribbaeus: Lazell 1964:250.

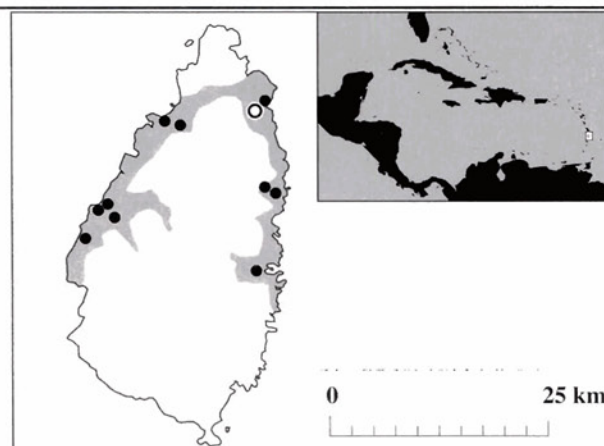
Bothrops caribbaea: Schwartz and Thomas 1975:179. See Remarks.

• **CONTENT.** *Bothrops caribbaeus* is monotypic.

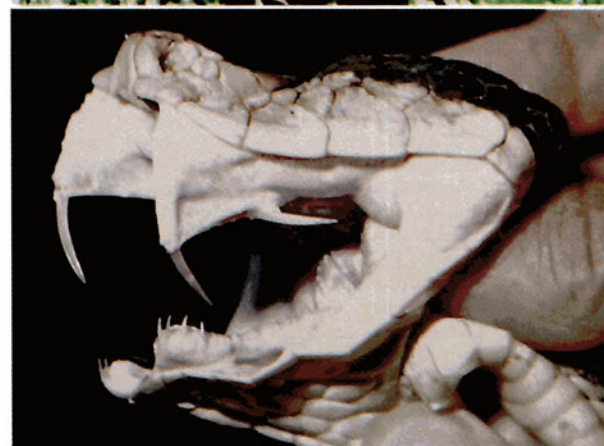
• **DEFINITION.** *Bothrops caribbaeus* ranges from 1,000–2,000 mm TL (Campbell and Lamar 1989); Schwartz and Henderson (1991) listed a maximum SVL of "about 1,300 mm." Head scutellation consists of 4–6 keeled intersupraoculars, 7–8 (typically 7) supralabials (the second integrated with the prelabial), and 9–11 infralabials. Midbody dorsal scale rows number 25–29, ventrals 196–213, and the divided subcaudals 64–72.

Dorsal ground color is usually gray to gray-brown, but variations of yellow and red exist. Color tends to be darker mid-dorsally. The venter is usually yellow or cream with lateral stipplings of gray, but these never comprise distinct markings. The dorsal surface of the head is either faintly patterned or patternless. Ground color of the head is generally like that of the dorsum of the body, but sometimes darker and occasionally nearly black. A dull, dark brown to black temporal stripe is directed toward the angle of the jaw, where it either terminates or fuses with dark pigment in the occipital region, unifying the neck pattern. The temporal stripe is never associated with the infralabials. A paler stripe borders the dark temporal stripe dorsally; its color is similar to that of the canthus and supralabials, which are usually cream, yellow, or tan. Whereas the canthus and supralabials are typically unpatterned, they may occasionally bear some rust-colored pigment. Chin color is correlated to the intensity of the ventral color; the more yellow the venter, the more the color of the chin deviates from white to cream.

Broad dorsal markings are variable, but associated with different dorsal ground colors; slate gray on pale gray, chocolate



Map. Range of *Bothrops caribbaeus* (modified from Lazell 1964 and Schwartz and Henderson 1991); the restricted type locality is marked with a circle, dots indicate other known records.



Figures 1 & 2. Adult *Bothrops caribbaeus* from L'Anse la Raye, L'Anse la Raye Parish, St. Lucia. Photographs by Richard A. Sajdak.

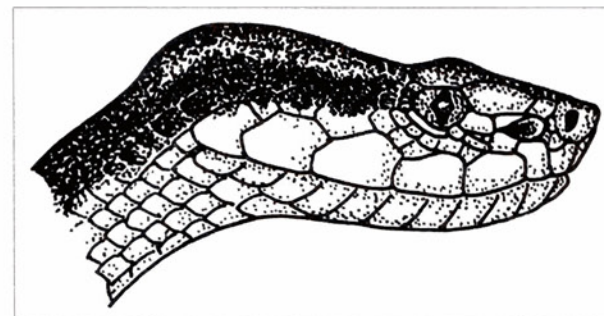


Figure 3. *Bothrops caribbaeus*, lectotype, MCZ 4814 (from Lazell 1964).

on brown, or rust-red on yellow are common pairings. Markings consist of lateral series of squares to trapezoids that may alternate or coincide across the dorsal midline; these are almost always most distinctive when they typically extend across the middorsal region. Consequently, an irregular, undulating, or zig-zag stripe connects the dorsal markings in many specimens. Generally, the pattern is most conspicuous on the anterior third of the body. The tail is gray to pink and bears irregular pale markings. The pale gray or copper-colored iris surrounding the elliptical pupil contains dark reticulations.

Males tend to be darker than females and may possess an olive tint. An ontogenetic tendency of pattern loss, predominantly laterally, is common. Juveniles have pink or yellow tails.

• **DIAGNOSIS.** *Bothrops caribbaeus* may be distinguished from its only other West Indian congener, *B. lanceolatus*, by having 25–29 dorsal scale rows at midbody (29–33 in *B. lanceolatus*), two rows of scales between the eyes and supralabials (usually three in *B. lanceolatus*), and 198–212 ventrals (208–240 in *B. lanceolatus*) (Schwartz and Henderson 1985, Campbell and Lamar 1989). Distinction from the mainland members of the *B. atrox* complex is rendered difficult due to the exceedingly variable nature of that group.

• **DESCRIPTIONS.** The original description by Garman (1887) is brief and fails to distinguish *B. caribbaeus* from *B. lanceolatus* and *B. atrox*, as do most publications prior to Lazell (1964). A brief description is in Long (1974). Lazell (1964), Campbell and Lamar (1989), and Schwartz and Henderson (1991) provided extensive and accurate descriptions.

• **ILLUSTRATIONS.** Color photographs are in Campbell and Lamar (1989), Campbell and Brodie (1992), and Powell et al. (1996). Underwood (1953) provided a black and white photograph of "*Bothrops atrox*," but he did not distinguish between *B. caribbaeus*, *B. lanceolatus*, and mainland forms, nor did he indicate the origin of the illustrated specimen. Based on the very distinct pattern, this specimen is not likely to have been *B. caribbaeus*. Dowling (1965) and Minton et al. (1968) included black-and-white photographs. A black-and-white photograph in Underwood (1995) shows a *Clelia errabunda* swallowing a *Bothrops caribbaeus* (see also Cope 1870).

Tyler (1849) provided a line drawing of the head (as *Craspedocephalus atrox* Gray). Plate IV, figure 1 in Amaral (1925), purportedly illustrating MCZ 4815, is in error (Lazell 1964) and may be *B. atrox*. Lazell (1964) included a line drawing of a lateral view of the head of the lectotype. Hoge (1965 [1966]) provided drawings of lateral and dorsal views of the head and a lateral view of the body of a paratype (IBH 23276, formerly MCZ 70201). Long (1974) reproduced Lazell's figure of the head and provided additional line drawings of the head with open mouth and erect fangs. Gosner (1987) provided drawings of dorsal body patterns of a nearly full-term embryo and an adult.

Because Proctor (1918) remarked that the figure of *Coluber lanceolatus* in Lacepède (1789) is "worthless, probably from a bleached specimen" and Duméril et al. (1854) noted that the "Vipère jaune de la Martinique" is also found in St. Lucia, the possibility exists that the figured specimen is *Bothrops caribbaeus*. Also, according to Proctor (1918), Plate 11, figure 4 in Jan (1875), labelled "var. *tesselatus*," is similar to a specimen in the British Museum from St. Lucia.

• **DISTRIBUTION.** *Bothrops caribbaeus* is restricted to peripheral lower elevations (< 200 m) of St. Lucia, except for the very dry extreme northern end of the island and, inexplicably, from the southern coastline (Lazell 1964, Schwartz and Thomas 1975). These snakes are said by locals to be most abundant in disturbed habitats (R.A. Sajdak, pers. comm.) and are common in cacao and coconut plantations, as well as relicual moist forest (Minton et al. 1968). Individuals "show a predilection for sheltering under piles of rocks and coconut husks," but "may frequently be encountered in trees" (Long et al. 1980). Lazell (1964) and Censky and Kaiser (1998) noted that the distributions of *B. caribbaeus* and *Boa constrictor orophias* are largely coastal and overlap completely, with *B. c. orophias* ranging

slightly higher. Censky and Kaiser (1998) suggested that such distributions might indicate relatively recent colonization combined with a slow spread through inhabited areas. The range has been illustrated in Lazell (1964), Long (1974), Campbell and Lamar (1989), and Schwartz and Henderson (1991).

Barbour (1914) disputed Boulenger's (1896) listing of venomous snakes on Guadeloupe and Dominica. A specimen agreeing with *B. caribbaeus*, supposedly from Dominica, was recorded in the BMNH register. Written in a "different hand" than that of G.A. Boulenger, in a section "interrupting" a series of entries by Boulenger, "beyond reasonable doubt this is an error" (Underwood 1995).

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** Tyler (1849) provided a brief description and commented on bites. Lazell (1964) separated the island taxa, *Bothrops caribbaeus* and *B. lanceolatus*, from mainland *B. atrox*, provided detailed descriptions, and discussed aspects of their biology. Hadley and Gans (1972) made note of two color morphs in the brightly pigmented tails of juveniles. Long (1974) provided notes on natural history and bites. Groves and Altamari (1979) reported captive propagation. Bites, manifestations of symptoms, and mortality were discussed by Long et al. (1980). *Bothrops caribbaeus* was included in a study by Groombridge (1986) of the *M. pterydoideus glandulae* in crotaline snakes. Gosner (1987) compared Lesser Antillean pitvipers to related mainland forms and suggested that both island species of *Bothrops* are part of the "polytypic *B. atrox* complex." He noted specifically that both West Indian forms "show such plasticity in habit and morphological detail as to suggest a minimal specialization and limited divergence from mainland *B. atrox*." Gosner (1988) discussed venomous snake bites in the Lesser Antilles. Greene (1992) listed *B. caribbaeus* among those pitvipers that are predominately terrestrial but occasionally will climb. Lillywhite and Smits (1992) provided data on oxygen consumption. Greene and Campbell (1992) listed *B. caribbaeus* among 74 crotaline species with restricted distributions. Salomão et al. (1997) and Wüster et al. (1997) used DNA sequencing to determine that *B. caribbaeus* is a sister taxon to South American populations of the *B. atrox* group.

This species is included under various synonyms in faunal lists, popular reports, guides, and checklists by Barbour (1914, 1930, 1935, 1937), Ditmars (1954), Underwood (1962), Klemmer (1963), Peters and Orejas-Miranda (1970), Hoge and Romano (1971), Schwartz and Thomas (1975), MacLean et al. (1977), Russell (1979), Harding and Welch (1980), Schwartz and Henderson (1985, 1988), Mattison (1986), Dixon and Smith (1993), Golay et al. (1993), Welch (1993, 1994), Frank and Ramus (1995), Ulber (1995), and Powell et al. (1996).

• **NOMENCLATURE HISTORY.** Contradictory interpretations of available material from the Lesser Antilles and the South American mainland resulted in considerable confusion in the early literature regarding the taxonomy of Antillean pitvipers. Animals from St. Lucia were frequently associated with *B. lanceolatus* from Martinique, but that name was also applied variously to mainland populations (see, for example, the synonymy in Mocquard 1909).

Gray (1842) may have described what is now recognized as *Bothrops caribbaeus* as either *B. subscutatus*, *B. Sabinii*, or *B. cinereus*, but his descriptions were insufficient to draw definitive conclusions, and locality data were either vague or probably in error (see below). Gray (1849) later considered all three names to be synonyms of *B. atrox*, rendering any association with a Lesser Antillean taxon more difficult. G. Underwood (in litt., 23.VII.92, to J.D. Lazell, Jr.) noted that, in an effort to determine if E. Sabine had collected on St. Lucia, he had examined two lots of *Bothrops*, a female from "Capt. Sabine, Berbice" (although Gray noted that *B. subscutatus* "inhabits Demerara," the specimen is listed as having come from Berbice) and two females and a male from "Col. Sabine, Demerara" (Berbice and Demerara are names of provinces and rivers in Guyana). All of these specimens had scale counts and pattern elements consistent with those of *B. caribbaeus*, but not with those of *B. atrox*.

from Guyana. Underwood wrote, "These observations suggest that the 'Berbice' and 'Demerara' specimens are most probably *B. caribbaeus*, a species known only from St. Lucia. The above considerations [which included additional references to specimens of *Clelia*, *Xenodon*, and *Oxyrhopus*, not otherwise known from that region of South America] raise a doubt that Sabine collected any specimens in Guyana." Because the "Demerara" specimens are the types of *B. subscutatus*, the "Berbice" specimen is the type of *B. Sabinii*, and either name would take precedence over *B. caribbaeus*, these specimens should be reexamined with that possibility in mind. If these specimens originated on St. Lucia, in the interest of nomenclatural stability, a petition to suppress Gray's names in favor of *B. caribbaeus* should be presented to the International Commission on Zoological Nomenclature. Hoge and Romano-Hoge (1978/1979 [1981]) listed *B. Sabinii* and *B. cinereus*, but not *B. subscutatus*, in their synonymy of *B. caribbaeus* and noted that, after examining the type specimens, they would determine the valid name.

Boulenger (1896) acknowledged Garman's (1887) paper (ignored by many), but followed many earlier workers in grouping with one another the island taxa now known as *B. caribbaeus* and *B. lanceolatus*, but he noted that his *Lachesis lanceolatus* might not be distinguishable from mainland *L. atrox*. Mocquard (1909) similarly grouped the island taxa, but noted that they differed from mainland forms in various ways. Barbour (1914) indicated that specimens from St. Lucia might prove to be distinct from those on Martinique. Amaral (1954 [1955]) said that the Martinican and Tobagan populations were indistinguishable, as were those from St. Lucia, Trinidad, and mainland areas. This confusion prevailed in the literature until Lazell (1964) firmly distinguished mainland and insular forms and suggested that the reason *B. caribbaeus* had so frequently been ignored and summarily lumped with *B. lanceolatus* was the previous paucity of material from St. Lucia. As a result, many older references (e.g., Brown 1893, Werner 1927, and others listed in the synonymy above or in that of Mocquard 1909) included under various synonyms snakes now known as *Bothrops caribbaeus*.

Sandner Montilla (1979), ignoring Lazell (1964) entirely, proposed a reversion to an earlier taxonomy by grouping the island populations (Martinique, St. Lucia, Tobago, Trinidad) with those of northern South America under the name *B. lanceolatus*.

• **REMARKS.** Although *Bothrops* is masculine (Campbell and Lamar 1992), some confusion arose as the result of Savage's (1950) determination that *Typhlops* is a Greek compound noun of feminine gender. A stickler for proper grammar, Albert Schwartz applied the latter to all West Indian taxa with generic names ending in *-ops* (D.R. Frost, 30.III.98, in litt.; R. Thomas, 8.IV.98, in litt.). In Schwartz and Thomas (1975), without comment, the name *Bothrops caribbaeus* first appeared as *B. caribbaea*. The latter has been used subsequently by Groves and Altimari (1979), Schwartz and Henderson (1985, 1988, 1991), Powell et al. (1996), and Censky and Kaiser (1998).

Lacépède (1789) coined the name "Fer-de-lance" for *Bothrops lanceolatus* from Martinique, and it is accurately used solely for that species (Minton and Minton 1969, Cendrero et al. 1972). However, Campbell and Lamar (1989) and Gosner (1988) noted that "Fer-de-lance" subsequently has been used widely and indiscriminately for both island and related mainland forms. Lazell (1964) noted that many authors (e.g., Ditmars 1954) have attributed the name to natives of Martinique, St. Lucia, or both. On both islands, however, pitvipers are usually referred to as "Serpent." Tyler (1849) used "Rat-tail Serpent," Russell (1979) used "Caribbean Pit Viper," and Frank and Ramus (1995) listed the common name "St. Lucia Lancehead," which we prefer.

Although considered semi-arboreal, individuals having been found as high as 6 m (Lazell 1964). Long (1974) also noted that this snake is a good climber. Nevertheless, these snakes appear to be less frequently encountered in trees than either *B. lanceolatus* or *B. insularis*.

Lazell (1964) noted that this species was not particularly rare and certainly not endangered. In fact, the introduction of the mongoose may have had an effect opposite that intended; larger specimens of *Bothrops* readily consume mongooses. During a more recent visit to St. Lucia (R.A. Sajdak, pers. comm.), the

considerable effort expended to find specimens suggested that the number of snakes had dwindled considerably since 1964.

Dowling (1965) provided an account of how Carib Indians introduced *Bothrops* to the islands in an effort to defeat the native Arawaks. He and Long (1974) both noted how unlikely that scenario was and that a much more plausible explanation involved dispersal from mainland South America. Müller (1973) noted ties of Antillean pitvipers to Guyanan faunal elements, and Hedges (1996) suggested "an origin by dispersal from South America in the late Tertiary or Quaternary (0–4 mya)."

In 1776, when both St. Lucia and Martinique belonged to France, the official coat-of-arms for the islands contained snakes rearing in a threatening manner (Gosner 1988).

• **ETYMOLOGY.** The species name, *caribbaeus*, is undoubtedly in reference to the Caribbean distribution of this form.

• **ACKNOWLEDGMENTS.** Peter J. Stafford examined the BMNH specimens and José Rosado the MCZ specimen at our request; both provided pertinent information. James Lazell provided copies of Underwood's correspondence regarding the types of *Bothrops subscutatus* and *B. Sabinii*. Jonathan Campbell made numerous helpful comments on an earlier draft of this account. Kraig Adler, Ellen J. Censky, Ronald I. Crombie, Darrel R. Frost, and Robert W. Henderson provided obscure references.

LITERATURE CITED

- Amaral, A. do. 1925. South American snakes in the collection of the United States National Museum. *Proc. U.S. Natl. Mus.* 67:1–30.
- . 1954 (1955). Contribuição ao conhecimento dos ofídios Neotrópicos. 35. A propósito de revalidação de *Coluber lanceolatus* Lacépède, 1789. *Mem. Inst. Butantan* 26:207–214.
- Barbour, T. 1914. A contribution to the zoogeography of the West Indies, with especial reference to amphibians and reptiles. *Mem. Mus. Comp. Zool.* 44:205–359 + 1 pl.
- . 1930. A list of Antillean reptiles and amphibians. *Zoologica (N.Y.)* 11:61–116.
- . 1935. A second list of Antillean reptiles and amphibians. *Zoologica (N.Y.)* 19:77–141.
- . 1937. Third list of Antillean reptiles and amphibians. *Bull. Mus. Comp. Zool.* 82:77–166.
- Boulenger, G.A. 1896. Catalogue of the Snakes in the British Museum (Natural History). Vol. 3, containing the Colubridae (Opisthoglyphe and Proteroglyphe), Amblycephalidae, and Viperidae. Trustees (British Museum), London.
- Brown, A.E. 1893. Notes on some snakes from tropical America lately living in the collection of the Zoological Society of Philadelphia. *Proc. Acad. Nat. Sci. Philadelphia* 1893:429–435.
- Campbell, J.A. and E.D. Brodie, Jr. (eds.). 1992. *Biology of the Pitvipers*. Selva, Tyler, Texas.
- and W.W. Lamar. 1989. *The Venomous Reptiles of Latin America*. Cornell Univ. Pr., Ithaca, New York.
- and —. 1992. Taxonomic status of miscellaneous Neotropical viperids with the description of a new genus. *Occ. Pap. Mus. Texas Tech Univ.* (153):1–31.
- Cendrero, L., F. de Buen, M.A. Freiberg, C.C. Olrog, and J. Yepes. 1972. *Zoología Hispanoamericana. Vertebrados. Edit. Porrúa, México, D.F.*
- Censky, E.J. and H. Kaiser. 1998. The Lesser Antillean fauna. In B.I. Crother (ed.), *Caribbean Amphibians and Reptiles*. Academic Press, San Diego.
- Cope, E.D. 1870. "Verbal communication, Aug. 2nd." *Proc. Acad. Nat. Sci. Philadelphia* 1870:90.
- Dixon, J.R. and H.M. Smith. 1993. *Bothrops* Wagler, 1824, p. 41–51. In P. Golay, H.M. Smith, D.G. Broadley, J.R. Dixon, C. McCarthy, J.-C. Rage, B. Schätti, and M. Toriba (eds.), *Endoglyphs and Other Major Venomous Snakes of the World: A Checklist. AZEMIOPS S.A., Herpetol. Data Ctr., Geneva*.
- Ditmars, R. 1954. *Snakes of the World*. Macmillan, New York.
- Dowling, H.G. 1965. The puzzle of the *Bothrops*; or, a tangle of serpents. *Anim. Kingdom* 68:18–21.
- Duméril, A.M.C., G. Bibron, and A.H.A. Duméril. 1854. *Erpétologie Générale ou Histoire Naturelle Complète des Reptiles*. Vol. 7, part 1. *Libr. Encyclopédique Roret, Paris*.
- Frank, N. and E. Ramus. 1995. *A Complete Guide to Scientific and*

- Common Names of Reptiles and Amphibians of the World. NG Publ., Inc., Pottsville, Pennsylvania.
- Garman, S. 1887. On West Indian reptiles in the Museum of Comparative Zoology, at Cambridge, Mass. *Proc. Amer. Phil. Soc.* 24:278–286.
- Golay, P., H.M. Smith, D.G. Broadley, J.R. Dixon, C. McCarthy, J.-C. Rage, B. Schätti, and M. Toriba. 1993. Endoglyphs and Other Major Venomous Snakes of the World: A Checklist. AZEMIOPS S.A., Herpetol. Data Ctr., Geneva.
- Gosner, K.L. 1987. Observations on Lesser Antillean pit vipers. *J. Herpetol.* 21:78–80.
- . 1988. Snakebite in the Lesser Antilles. *Bull. Maryland Herpetol. Soc.* 24:1–6.
- Gray, J.E. 1842. Synopsis of the species of rattle-snakes, or family of Crotalidae. *Zool. Misc.* 2/3:47–51.
- . 1849. Catalogue of the Specimens of Snakes in the Collection of the British Museum. Trustees (British Museum), London.
- Greene, H.W. 1992. The ecological and behavioral context for pitviper evolution, p. 107–117. *In* J.A. Campbell and E.D. Brodie, Jr. (eds.), *Biology of the Pitvipers*. Selva, Tyler, Texas.
- and J.A. Campbell. 1992. The future of pitvipers, p. 421–427. *In* J.A. Campbell and E.D. Brodie, Jr. (eds.), *Biology of the Pitvipers*. Selva, Tyler, Texas.
- and W.W. Lamar. 1989. *The Venomous Reptiles of Latin America*. Cornell Univ. Pr., Ithaca, New York.
- Groombridge, B. 1986. Comments on the *M. pterygoideus glandulae* of crotaline snakes (Reptilia: Viperidae). *Herpetologica* 42:449–457.
- Groves, J.D. and W. Altimari. 1979. First breeding of the St. Lucia serpent *Bothrops caribbaea* in captivity. *Internatl. Zoo. Yearb.* 19:101–102.
- Hadley, W.F. and C. Gans. 1972. Convergent ontogenetic change of color pattern in *Elaphe climacophora* (Colubridae: Reptilia). *J. Herpetol.* 6:75–78.
- Harding, K.A. and K.R.G. Welch. 1980. *Venomous Snakes of the World, a Checklist*. Pergamon Press, New York.
- Hedges, S.B. 1996. The origin of West Indian amphibians and reptiles, p. 95–128. *In* R. Powell and R.W. Henderson (eds.), *Contributions to West Indian Herpetology: A Tribute to Albert Schwartz*. SSAR, Ithaca, New York.
- Hoge, A.R. 1965 (1966). Preliminary account on Neotropical Crotalinae (Serpentes Viperidae). *Mem. Inst. Butantan* 32:109–184.
- and S.A.R.W.D.L. Romano. 1971. Neotropical pit vipers, sea snakes, and coral snakes, p. 211–293. *In* W. Bücherl and E. Buckley (eds.), *Venomous Animals and Their Venoms*. Vol. 2. Academic Press, New York and London.
- and S.A.R.W.D.L. Romano-Hoge. 1978/1979 (1981). Poisonous snakes of the world. Part 1: Check list of the pit vipers Viperidae, Viperidae, Crotalinae. *Mem. Inst. Butantan* 42/43:179–309.
- Jan, G. 1875. *In* G. Jan and F. Sordelli, *Iconographie Générale des Ophiidiens*. 47me livr. J.B. Baillière et Fils, Paris.
- Klemmer, K. 1963. Liste der rezenten Giftschlangen: Elapidae, Hydrophidae, Viperidae und Crotalidae. N.G. Elwert Univ. Verlagsbuchhandl., Marburg/Lahn.
- Lacépède, B.-G.-É. 1789. *Histoire Naturelle des Quadrupèdes Ovipares et des Serpens*. Vol. 2. Hôtel de Thou, Paris.
- Lazell, J.D., Jr. 1964. The Lesser Antillean representatives of *Bothrops* and *Constrictor*. *Bull. Mus. Comp. Zool.* 132:245–273.
- Lillywhite, H.B. and A.W. Smits. 1992. The cardiovascular adaptations of viperid snakes, p. 143–153. *In* J.A. Campbell and E.D. Brodie, Jr. (eds.), *Biology of the Pitvipers*. Selva, Tyler, Texas.
- Long, E.G. 1974. The Serpent's Tale. Reptiles and Amphibians of St. Lucia. IOUANALOA Ser. 2. Univ. W. Ind. Extramural Dept., St. Lucia.
- , D. Brill, and M. Fevrier. 1980. Snakebite in a rural community in St. Lucia. Unpubl. rep. to the Ministry of Health, Housing, and Labor, Castries, St. Lucia.
- MacLean, W.P., R. Kellner, and H. Dennis. 1977. Island lists of West Indian amphibians and reptiles. *Smithson. Herpetol. Info. Serv.* (40): 1–47.
- Mattison, C. 1986. *Snakes of the World*. Facts on File Publ., New York and Oxford.
- Minton, S.A., H.G. Dowling, and F.E. Russell. 1968. Poisonous Snakes of the World. A Manual for Use by the U.S. Amphibious Forces. Dept. Navy, Bur. Med. Surgery, U.S. G.P.O., Washington, D.C.
- and M.R. Minton. 1969. *Venomous Reptiles*. Charles Scribner's Sons, New York.
- Mocquard, F. 1909. Livraison 17, p. 933–1012. *In* M.A. Duméril, M.-F. Bocourt, and F. Mocquard. *Études sur les reptiles. In Recherches Zoologiques pour servir à l'Histoire de la Faune de l'Amérique Centrale et du Mexique*. Part 3, sect. 1. Imprimerie Natl., Paris.
- Müller, P. 1973. The Dispersal Centres of Terrestrial Vertebrates in the Neotropical Realm. Dr. W. Junk, Den Haag.
- Peters, J.A. and B.R. Orejas-Miranda. 1970. Catalogue of Neotropical Squamata: Part I. Snakes. *Bull. U.S. Natl. Mus.* (297):1–347.
- Powell, R., R.W. Henderson, K. Adler, and H.A. Dundee. 1996. An annotated checklist of West Indian amphibians and reptiles, p. 51–93 + 8 pl. *In* R. Powell and R.W. Henderson (eds.), *Contributions to West Indian Herpetology: A Tribute to Albert Schwartz*. SSAR, Ithaca, New York.
- Proctor, J.B. 1918. On the variation of the pit viper, *Lachesis atrox*. *Proc. Zool. Soc. London* 1918:163–182.
- Russell, F.E. 1979. The clinical problem of crotalid snake poisoning, p. 978–996. *In* C.-Y. Lee (ed.), *Snake Venoms*. Handbook of Experimental Pharmacology. Vol. 52. Springer Verlag, Berlin, Heidelberg, New York.
- Salomão, M. da G., W. Wüster, R.S. Thorpe, J.-M. Touzet, and BBBSP (Butantan-British *Bothrops* Systematic Project). 1997. DNA evolution of South American pitvipers of the genus *Bothrops* (Reptilia: Serpentes: Viperidae), p. 89–98. *In* R.S. Thorpe, W. Wüster, and A. Malhotra (eds.), *Venomous Snakes: Ecology, Evolution and Snakebite*. Zool. Soc. London and Oxford Univ. Press, Oxford.
- Sandner Montilla, F. 1979. La necesaria revalidación de *Bothrops lanceolatus* (Lacépède, 1789) y el paso a sinónimia de *B. colombiensis* (Hallowell, 1845). *Mem. Cient. Ofidol.* (3):1–7.
- Savage, J.M. 1950. Two new Blind Snakes (genus Typhlops) from the Philippine Islands. *Proc. California Zool. Club* 1:49–54.
- Schwartz, A. and R.W. Henderson. 1985. *A Guide to the Identification of the Amphibians and Reptiles of the West Indies exclusive of Hispaniola*. Milwaukee Pub. Mus., Milwaukee, Wisconsin.
- and —. 1988. West Indian amphibians and reptiles: a check-list. Milwaukee Pub. Mus. Contr. Biol. Geol. 74:1–264.
- and —. 1991. *Amphibians and Reptiles of the West Indies: Descriptions, Distributions, and Natural History*. Univ. Florida Press, Gainesville.
- and R. Thomas. 1975. A check-list of West Indian amphibians and reptiles. *Carnegie Mus. Nat. Hist. Spec. Publ.* (1):1–216.
- Tyler, R.E. 1849. Notes on the serpents of St. Lucia. *Proc. Zool. Soc. London* 1849:100–104.
- Ulber, T. 1995. *Bothrops caribbaeus*, p. 41.1. *In* T. Ulber (ed.), *Catalogue of Valid Species and Synonyms*. Vol. 1. Crotalidae. Herprint Internatl., Pretoria.
- Underwood, G. 1953. West Indian reptiles. *Carib. Quart.* 3:174–180.
- . 1962. Reptiles of the eastern Caribbean. *Carib. Affairs n.s.* 1. Dept. Extra-mural Stud., Univ. W. Ind., Port-of-Spain, Trinidad.
- . 1995. A Tale of Old Serpents. St. Lucia Natl. Trust, St. Lucia, W.I.
- Welch, K.R.G. 1993. *Living Reptiles and Amphibians of the World: A Checklist and Bibliography*. (Series B). No. 5. Pitvipers (Viperidae: Crotalinae). R & A Res. Info. Ltd., Somerset, England.
- . 1994. *Snakes of the World: A Checklist*. 1. Venomous Snakes. R & A Res. Info. Ltd., Somerset, England.
- Werner, F. 1927. Neue oder wenig bekannte Schlangen aus dem Wiener naturhistorischen Staatsmuseum (III. Teil). *Sitzungsber. Akad. Wiss. Wien, Math. Naturwiss. Kl., Abt. I*, 135:243–257.
- Wüster, W., M.G. Salomão, R.S. Thorpe, G. Puerto, M.F.D. Furtado, S.A. Hoge, R.D.G. Theakston, and D.A. Warrell. 1997. Systematics of the *Bothrops atrox* complex: new insights from multivariate analysis and mitochondrial DNA sequence information, p. 99–113. *In* R.S. Thorpe, W. Wüster, and A. Malhotra (eds.), *Venomous Snakes: Ecology, Evolution and Snakebite*. Zool. Soc. London and Oxford Univ. Press, Oxford.

ROBERT POWELL (powellr@mail.avila.edu) and **RODNEY D. WITTENBERG**, Department of Natural Sciences, Avila College, Kansas City, MO 64145.

Primary editor for this account, Larry David Wilson.

Published 30 November 1998 and Copyright © 1998 by the Society for the Study of Amphibians and Reptiles.